

Rakennusjätteiden komposiiteiksi kierrätyksen kestävyys

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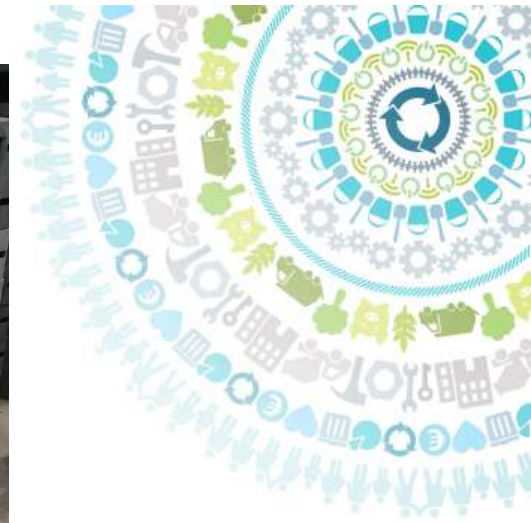
CIRCWASTE – Etelä-Karjala



- LUT yliopiston hanke
 - Planning for re-materialization: Developing composite fibre products and processing machinery for municipal, industrial and C&D waste fractions
 - Validation of the sustainability of the re-materialization process as a part of the integrated waste management and recovery system
- Lappeenrannan kaupungin hanke
 - Alueellisen yhteistyöryhmän koordinointi
- Wimao Oy:n hanke
 - Implementation of re-materialization – Building a pilot plant for waste fraction composite manufacturing

Wimao Oy Komposiittituotteita rakennusjätteestä

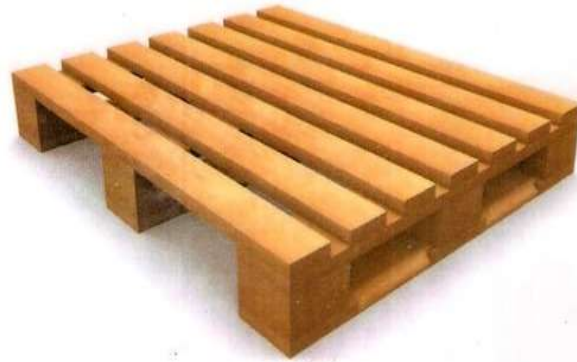
- CIRCWASTE –rahoituksella
demonstraatiolaitos
Lappeenranan
Kukkuroinmäkeen
- Ensimmäinen kaupallinen
tuote kierrätyskomposiitista
valmistettu kuormalava



Background

- Types

- wooden pallet,
- plastic pallet,
- fibre-plastic composite pallet



Research question

1. What are the environmental impacts of WPC pallets produced from construction and demolition waste (CDW) compared to the wooden pallets and plastic pallets?

LCA Considerations



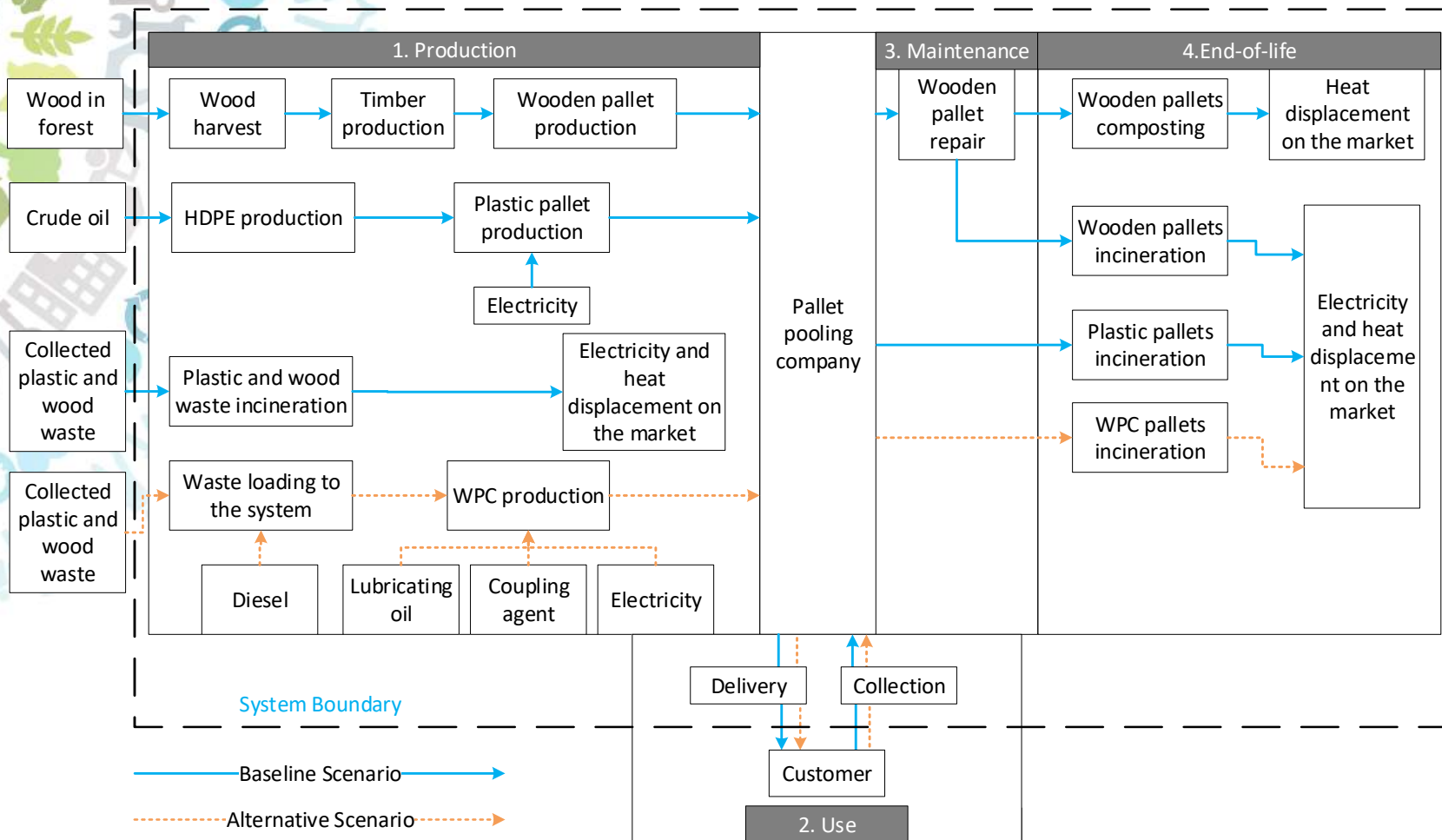
	Wooden pallet	Plastic pallet	WPC pallet
Material	Virgin wood	Virgin plastic	Waste wood and plastic composite
Dimensions (mm)	1200 x 800 x 144	1200 x 800 x 144	1200 x 800 x 144
Weight (kg)	21.8	20	14.8
Repair	Every 7 cycles	Not possible	Not possible
Expected lifetime (cycles)	20	66	66
End of life	90% incineration+10% material recovery	100% incineration	100% incineration

LCA method

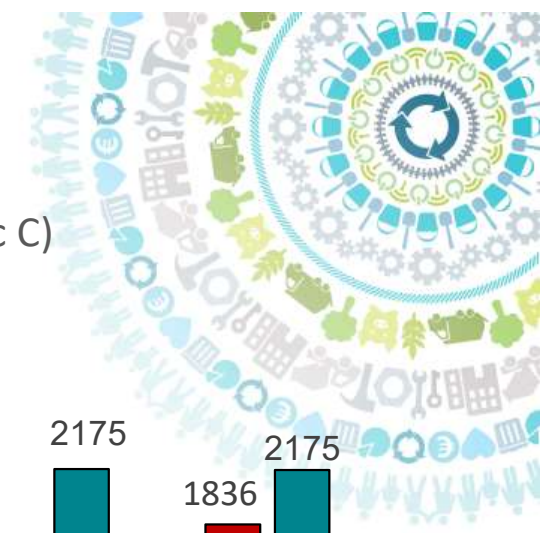
- Cradle to grave
- FU: 1000 trips
- End-of-life 0:100 with credit system
- GaBi 8.6.0.20
- CML 2001-Jan.2016



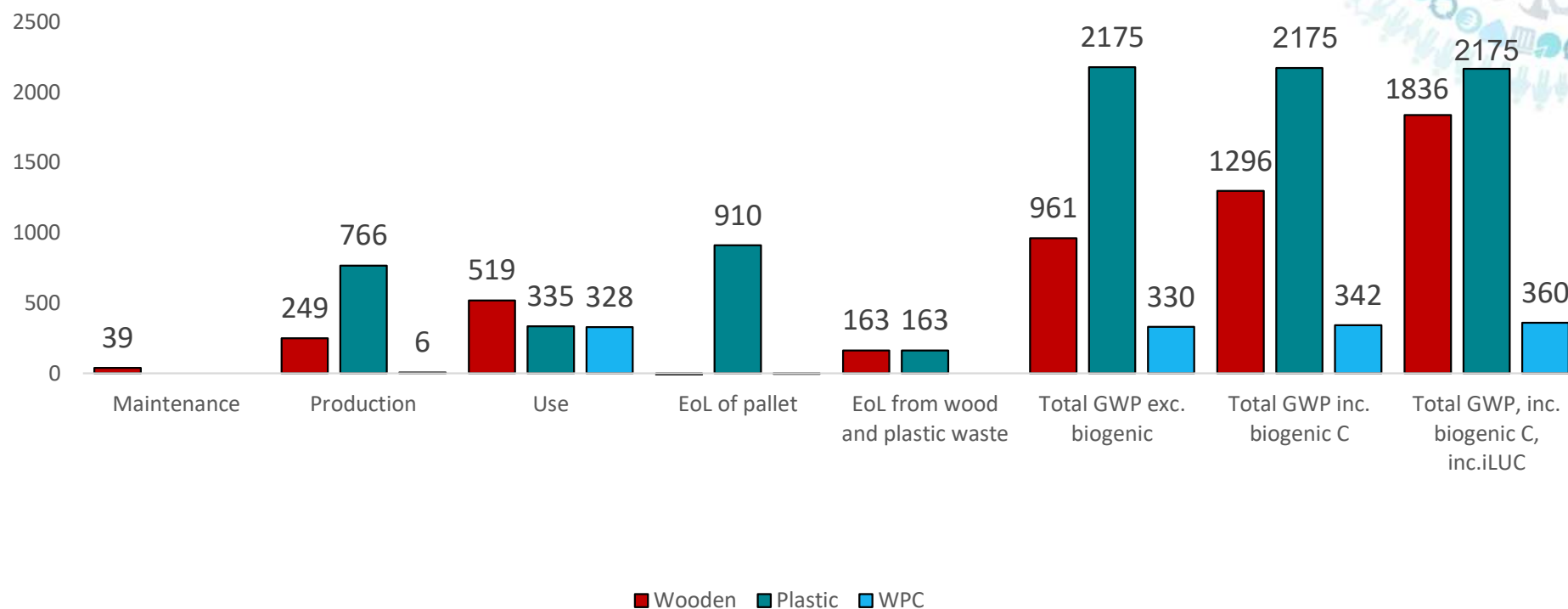
System Boundary for CLCA



CLCA results



GWP (exc. biogenic C), GWP (inc. biogenic C), iLUC (inc. biogenic C)
[kg CO₂ eq. (1000 trips)⁻¹]



Summary

- WPC komposiittikuormalavan ilmastovaikutus on pienin
- Kuormalavojen elinkaaren lopussa energiahyötykäyttö tärkeä
 - Korvattiin ja käytettiin marginaalienergiaa (tuuli- ja aurinkosähkö, biomassalämpö)
 - Kierrätyksellä voitaisiin pienentää vaikutusta
 - mahdollista, mutta ei järjestelmää
- Käyttöikä (käyttökertojen lukumäärä) on tärkeä
 - merkittävää epävarmuutta
- Kuormalavan painolla jonkin verran merkitystä



Julkaisuja



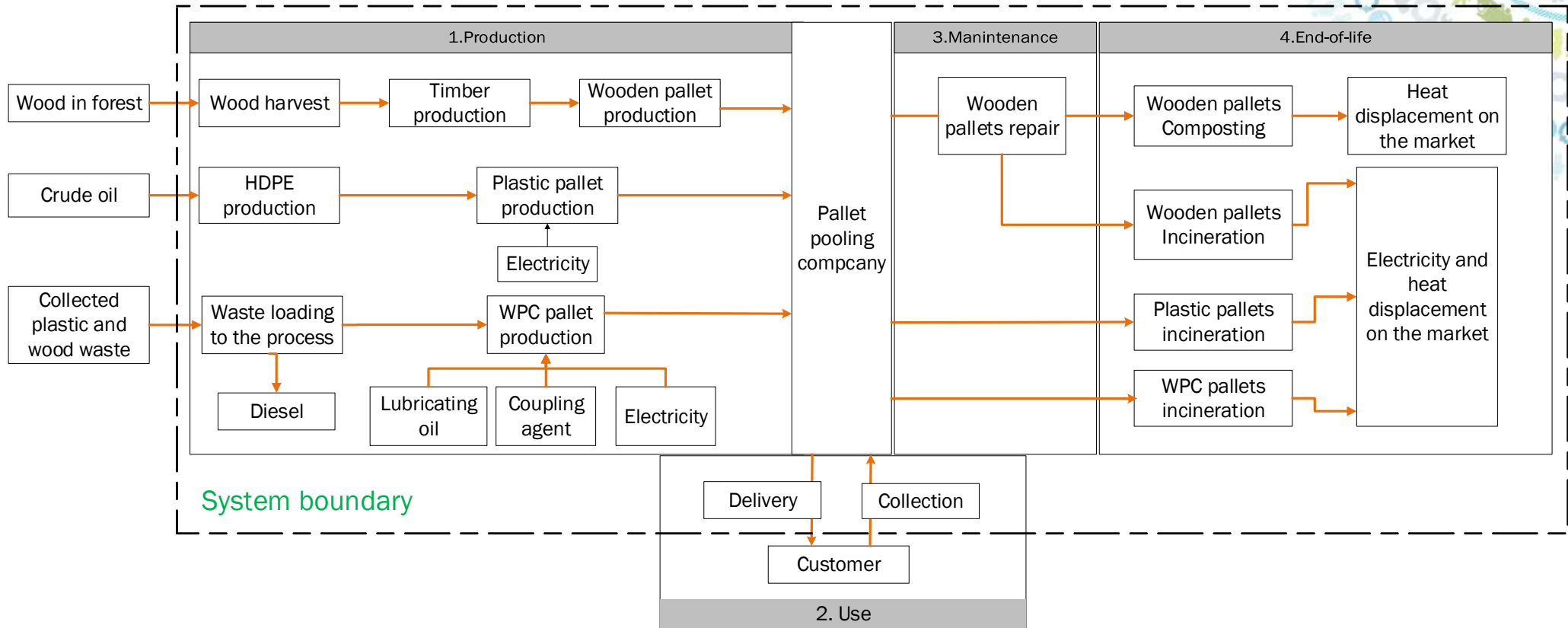
- Khan M., Deviatkin I., Havukainen J., Horttanainen M., **Environmental Impacts of Wooden, Plastic, and Wood-polymer Composite Pallet: A Life Cycle Assessment Approach**. *International Journal of Life Cycle Assessment*, 2021.
<https://doi.org/10.1007/s11367-021-01953-7>
- Khan M., **Environmental Impacts of the Utilisation of Challenging Plastic-Containing Waste**. Dissertation thesis. LUT University, 2022.
- Deviatkin I., Khan M., Ernst E., Horttanainen M., Wooden and plastic pallets: A review of life cycle assessment (LCA) studies. *Sustainability* 2019, 11(20), 2019.
- Deviatkin I., Horttanainen M., Carbon footprint of an EUR-sized wooden and a plastic pallet. ICEPP 2019. E3S Web of Conferences 158, 03001 (2020).

Thank you



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University

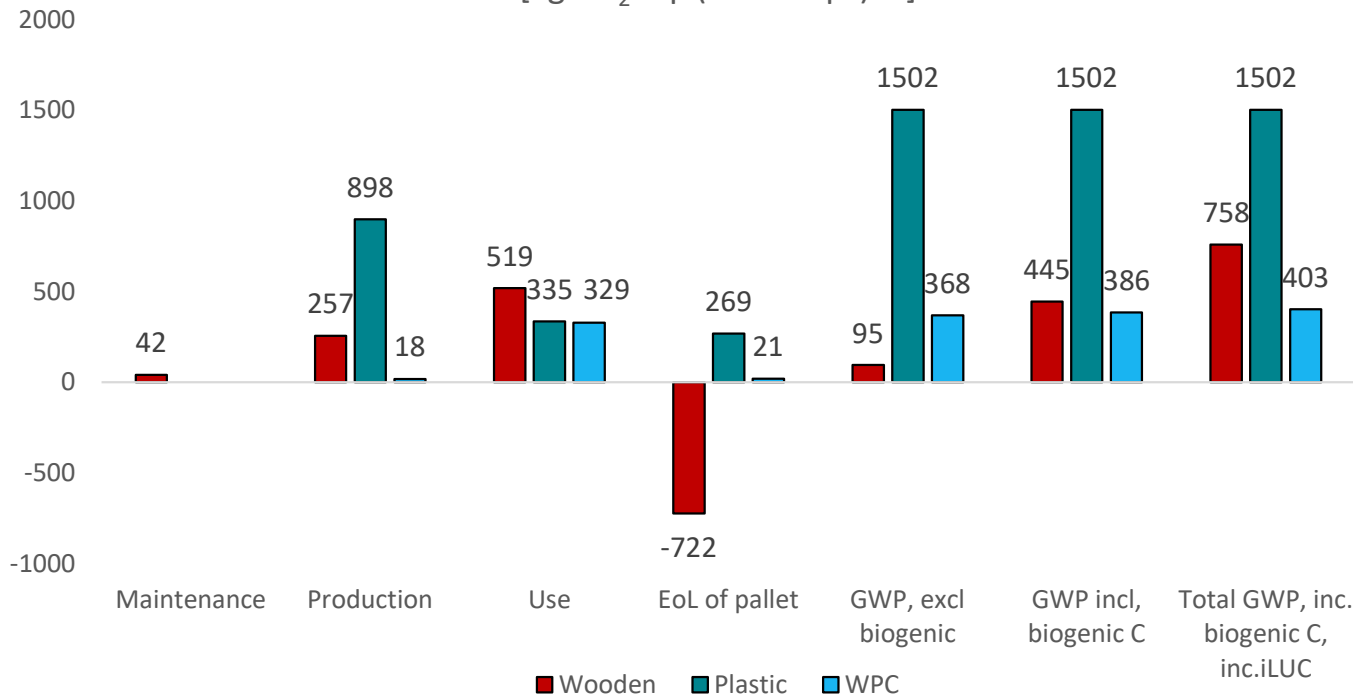
System boundary for ALCA



ALCA results



GWP (exc. biogenic C), GWP (inc. biogenic C), iLUC (inc. biogenic C)
[kg CO₂ eq. (1000 trips)⁻¹]



- Average energy mix
- Production
 - Plastic 40% of impact
- Use: wooden pallet is heaviest
- EoL: Impact of displacing average energy
- Biogenic emissions
 - Impact on: Wood and WPC